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(In)efficiency of the Sugar Production in European Union - a Microeconomic Approach

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Abstract: Sugar production in the world amounted to € 53.5 Bill. in 2012. It can be produced using sugar cane in tropical and subtropical climate belt or sugar beet in moderate climate. In this paper the input allocation efficiency is analysed. First part of the efficiency analysis is the microeconomic analysis of transformation of two inputs (cane and beet) into sugar. It is shown that there is no microeconomic approval for sugar production from sugar beet. Further analysis has shown that vast areas of arable land in EU could be reallocated to more profitable cultures but it would then cause price shocks on the other agricultural markets. Finally, it is shown that Croatian farmers do not have to raise revenues per hectare by switching from sugar beet to other cultures, but only to improve low productivity in its production, since the yields are below the EU average by 24%.

Keywords: Perfect substitutes, agriculture, sugar beet, sugar cane, CES production function

JEL Classification: D240

Introduction

Sugar market is one of the most significant segments of the food industry; the sold amount of sugar in 2013 was € 53.5 Bill (Versteijlen, 2014). European Union is one of the greatest producers and consumers of sugar in the world, but there is a question of how efficient the sugar production is. Sugar can be produced from either sugar beet or sugar cane. Sugar cane accounts for 78% of the sugar production in the world and the rest is produced from sugar beet (FAO). This paper will underline significant differences in the commodity production and the costs of production, discuss the current choices of inputs and comment on the possible ways how to increase revenues per hectare of the arable land currently used for sugar beet in European Union and especially in Croatia.

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Sugar cane is produced almost exclusively for sugar production, which is then used as either a final product or as a commodity for other industries, like alcohol production. There are also some significant by-products, like molasses, which are then used as food for cattle or by other industries. Sugar beet is also almost exclusively produced for sugar production with similar by-products, but there are some significant differences in the ways these crops are produced regarding the soil, vegetation and the latitude. Also, sugar cane has less sugar (standard content of sugar is 12% on average), while sugar beet is more abundant in sugar (an average content is 16%). (Dahlia , 2009).

Cane is produced in tropical and subtropical areas (between the latitudes 33°N and 33°S) and it is perennial plant, while sugar beet grows in a humus rich and well-drained soil in the temperate areas. Unlike sugar cane, sugar beet is a biennial plant which in turn means it requires annual sowing costs which then increases the costs of production (Czarnikow Sugar 2011/12 database). Given the agricultural prerequisites, sugar cane and sugar beet are not switchable from one to another on the same soil. The only way is to specialize in some other culture and import the other which yields less profit per hectare. It is the principle of the Ricardian theory of international trade. Furthermore, the transportation costs of the sugar cane and sugar beet dictate that the sugar factories are built near the commodity growing areas.

This paper will examine several aspects of sugar production; first, the microeconomic efficiency of the choice of inputs for sugar production will be examined; secondly, the possible alternative uses for potentially vacated land in European Union will be discussed; finally, the efficiency of the sugar beet production in Croatia will be discussed, with respect to the revenues per hectare and metric tons per hectare.

Sugar Production Optimization

Sugar production is based either on sugar beet or sugar cane. The other inputs, such as energy, capital, etc., will be ignored for the time being. Furthermore, sugar cane and sugar beet are perfect substitutes. The perfect substitutes production function is based on the CES production function:

$$q(x_1, x_2) = (\alpha x_1^\rho + \beta x_2^\rho)^{\frac{1}{\rho}}$$

with $\rho = 1$. Hence the perfect substitutes production function is:

$$q(x_1, x_2) = \alpha x_1 + \beta x_2$$

If S stands for sugar, C for sugar cane and B for sugar beet, all measured in metric tons, the production function is:

$$S(B, C) = \alpha B + \beta C$$

The international price setting standard for sugar cane and sugar beet are set for 12% sugar content cane and 16% sugar content beet (Dahlia, 2009). Hence $\alpha = 0.16$ and $\beta = 0.12$ and the final production function is:

$$S(B, C) = 0.16B + 0.12C$$

Average sugar cane price on the Indian market in 2013 was €29.50. The prices in the other sugar cane producing countries were similar. Sugar beet prices varied a lot (see Table A3), but these prices do not take into account the subsidies obtained by the government. UK secretary for agriculture published the real price of sugar beet: 63€ per metric ton.

In the year 2013 the world sugar production was 179 million tons. The problem of expenditure minimization then becomes:

$$\min TE(B, C) = 63B + 29.5C$$

subject to

$$179 \cdot 10^9 = 0.16B + 0.12C$$

Since marginal rate of technical substitution is $MRTS_{BC} = \frac{MP_B}{MP_C} = \frac{0.16}{0.12} = 1.333$

and the commodity price ratio $63/29.5 = 2.136$, there is no interior solution. The solution is a corner solution, $B = 0$ and $C = 1.492 \cdot 10^9$. In other words, the total sugar amount produced in 2013 could have been produced with 1.492 billion tons of sugar cane.

The production of sugar beet in 2013 was 246 million tons and production of sugar cane was 1.164. The commodity costs in 2013 were:

$$TE_{2013} = 63 \cdot 0.246 + 29.5 \cdot 1.164 = \text{€}49.84 \text{ Bill.}$$

If only sugar cane were used, the same amount of production would have been produced with the following costs (according to the results of the expenditure minimization):

$$TE'_{2013} = 63 \cdot 0 + 29.5 \cdot 1.492 = \text{€}44.01 \text{ Bill.}$$

Figure 1: Equilibrium in the world production of sugar in 2013

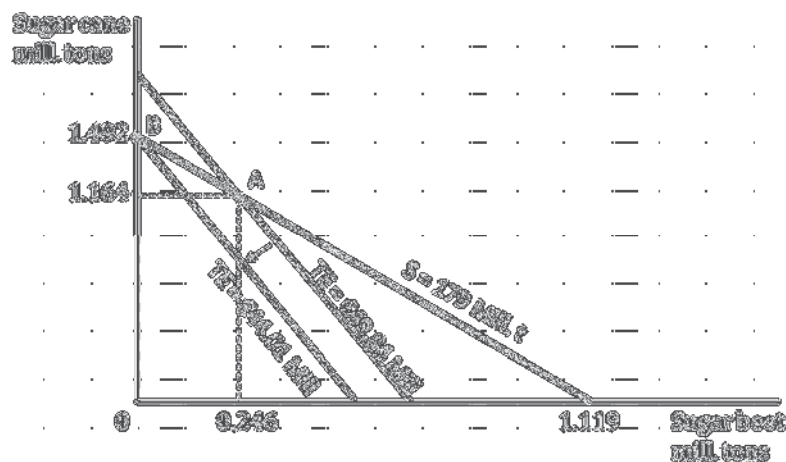


Figure 1 shows the actual (A) and the optimal (B) production point. It would be more efficient if production of sugar beet were stopped and all the sugar produced using sugar cane. That shift would cause an 11,7% decrease in costs.

Land Owner's Revenue Maximization

While sugar can be produced by either sugar cane or sugar beet, the land used for their production is not switchable; sugar cane grows on all types of soils in tropical and subtropical areas and sugar beet requires a quality soil with good drainage ability and can grow only in temperate zones. Hence if sugar beet producing countries decided to stop its production, it should be brought to some other purpose. However, these are vast areas of arable land: almost 2.5 million hectares in the European Union only. Croatia had 20 000 hectares planted with sugar beet in 2012 (Table A1).

Therefore an answer to the question of the land use should be made, but special attention should be given to each agricultural product market since such wide areas would cause large increase in the world production of certain products which would in turn cause disturbances on the markets, decrease in the profitability of the other cultures and farmers' discontent. Hence it is hardly likely that the Ricardian theory of international trade should be applied in this matter. Economically, consumers would be better off, but producers could find it very hard to conform to new conditions. Also, the price of sugar produced from sugar cane would probably go up since it is mostly controlled by Brazil and India.

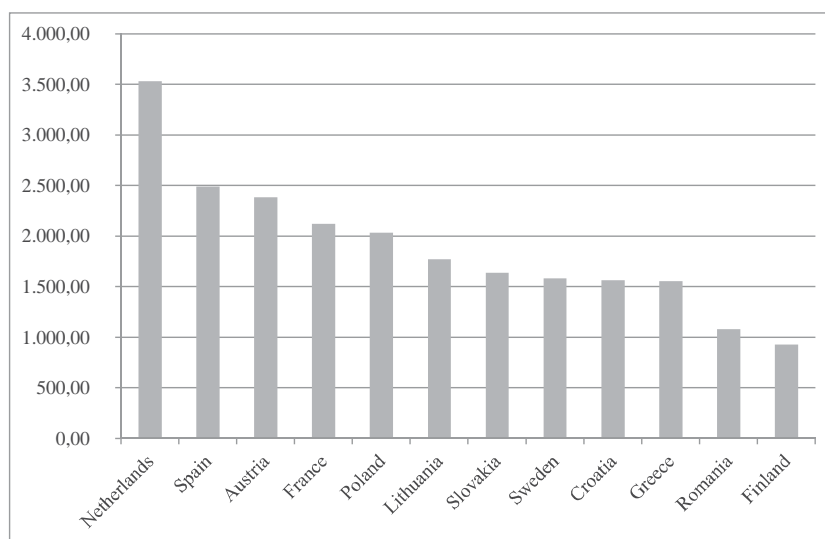
The switch from sugar beet to other cultures could be done from on the micro level: observing the profitability of sugar beet across EU, it can be seen that it varies

a lot (Table A6). Hence the countries with lower beet productivity could shift its production to more profit-yielding cultures such as fruits and vegetables, which are labour-intensive.

Croatia is big importer of food. The only export of Croatian agriculture are mandarins (DZS, 2013). Hence Croatia should increase the number of orchards and vegetable production. Since Croatia has many other less-profitable agricultural production and big areas of unused land, it should first start by using the unused land and substituting the low-revenue grain production. In that case, sugar beet production would remain stable in Croatia. This analysis though could be the basis for some future surveys.

The second way of improving land use and profitability of Croatian agriculture is raising the productivity. Croatian farmers are far from the most profitable Dutch sugar beet farmers: while Croatian farmer had an income of 2153€ per hectare of sugar beet in 2011, Dutch farmer had 3596€ per hectare (Table A5, Figure 2).

Figure 2: Average revenue per hectare of sugar beet in 2012 in European Union

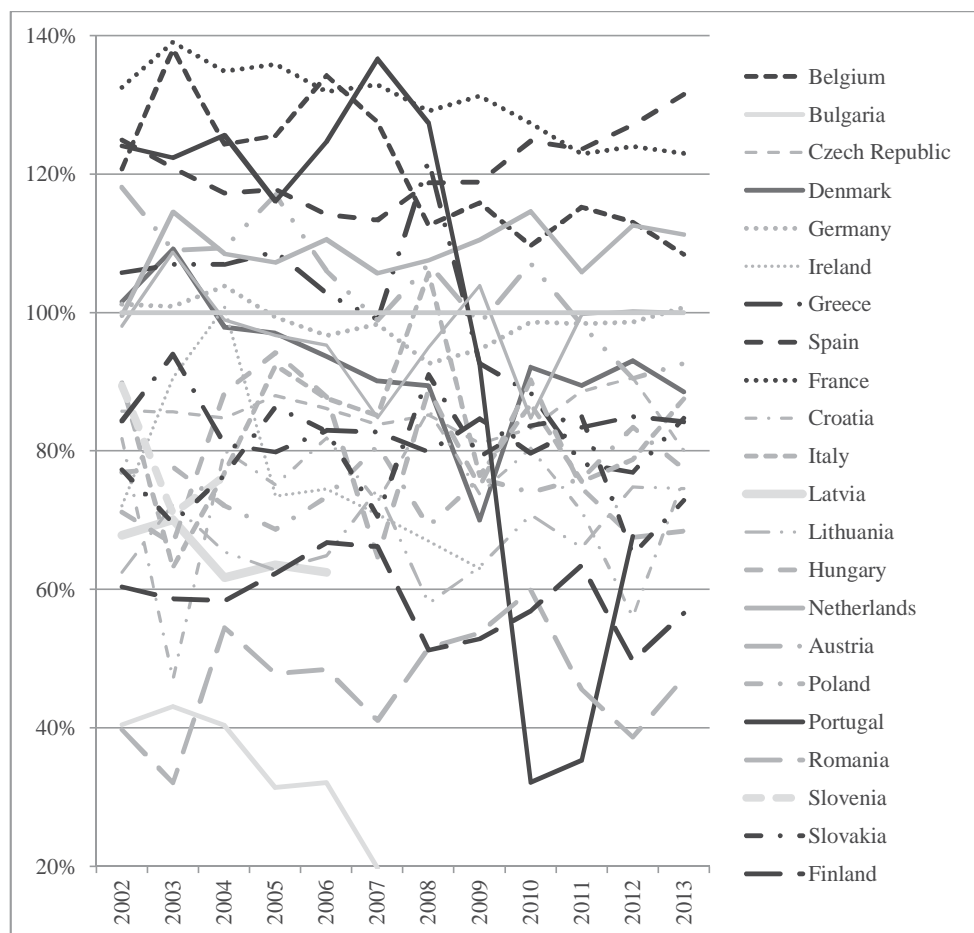


Source: Eurostat

In 2012 the difference escalated even more showing that Dutch farmer earned more than 4700€ per hectare. One part of the low profitability is lower price (Netherlands in 2012: 60€, Croatia: 45€) but still sugar industry in Croatia pays more for sugar beet than it is the case in majority of the EU (Table A3). The greatest problem of Croatian sugar beet production is low yields (Figure 3).

One can see from the Figure 3 that Croatia is much below the EU average yields (100%). France reaches the highest yields (always at least 20% better than the EU average).

Figure 3: Productivity of the sugar beet production compared to the European Union average



Source: Eurostat

Conclusion

Sugar production in the world uses sugar cane and sugar beet as prime commodities for its production and microeconomically speaking they are perfectly substitutable inputs. Although beet has greater content of sugar than cane, sugar beet is much more costly than cane and as a result of the microeconomic production optimization, only sugar cane should be used for its production. However, the soil and the areas used for sugar cane and sugar beet are not interchangeable; while

sugar beet grows in northern temperate areas, sugar cane grows in southern tropical and subtropical areas.

Europe has large sugar beet production and is almost self-sufficient in the sugar production. If the microeconomic laws were applied, 2,5 million hectares of arable land would be available for other agricultural production, but there is a problem of finding the substitutable cultures to be grown on such vast areas of land. It could cause slump in prices of the newly produced cultures goods and cause disturbances on majority of agricultural markets. Therefore such decision should take many more factors into account before deciding to diminish sugar beet production.

Croatia could substitute the land used for sugar beet production, but there is no need for it since it already has vast areas of unused land and grows lots of grain which is the least profitable of all agriculture. Secondly, its sugar beet productivity is much below the EU average (76% of the EU average in 2012). Therefore the revenues per hectare could be increased not only by switching to more profitable vegetable and fruit production, but also by the improvement of the sugar beet production process.

Appendix

Table A1: Sugar beet area (1000 ha) in the EU countries

geo/time	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Belgium	93,9	88,6	84,2	78,7	70,7	70,8	62,3	62,7	62,4	62,2	61,2	59,8
Bulgaria	2,2	0,4	1,1	1,3	1,4	1,3	0	0	0	0	0	0
Czech Republic	77,5	77,3	71,1	65,6	61	54,3	50,4	52,5	56,4	58,3	61,2	62,4
Denmark	57,8	49,6	48,7	47	41,4	39,4	36,4	38	39,2	40	40,8	38
Germany	459,4	445,6	440,5	420,1	357,6	402,7	369,3	383,6	364,1	398,1	402,1	357,9
Ireland	31,3	31,5	31,1	31	1,7	1	1	1	0	0	0	0
Greece	41,5	39	33	42,5	26,9	13,6	14,2	24,2	13,2	5,5	8,1	5,8
Spain	113,8	99,8	103,1	102	85,5	68,2	52,3	49,8	43,4	44,9	39	31,2
France	437,7	399,8	384,6	378,5	379,3	393,5	349,3	372,6	383,1	435,5	389,8	394,9
Croatia	25,1	27,3	26,5	29,4	31,9	34,3	22	23,1	23,8	21,7	23,5	20
Italy	245,7	214,2	185,8	253	91,2	85,6	61,8	60,6	62,7	62,2	45,5	45,3
Latvia	15,9	14,4	13,8	13,5	12,7	0,3	0	0	0	0	0	0
Lithuania	29,2	25,6	23,3	21	18,5	16,9	8,7	15,1	15,3	17,6	19,2	17,7
Hungary	55,4	51,6	61,9	61,6	46,8	41,2	9,6	13,8	13,9	15,2	18,7	17,7
Netherlands	108,9	102,8	97,7	91,3	82	82,1	72,2	72,7	70,6	73,3	73	73,2
Austria	44,7	43,2	44,7	44,2	39,4	42,3	43	43,9	44,8	46,6	49,3	50,8
Poland	303	286,3	297,3	286,2	262	247,4	187,5	199,9	206,4	203,5	212	194,1
Portugal	9	7,5	8,4	8,6	4,3	2,9	1,6	0,1	0,2	0,3	0,4	0
Romania	41,6	45,2	20,8	25,2	39,8	28,7	20,4	21,3	21,8	18,9	27,4	28,2
Slovenia	4,5	5,4	4,7	0	0	0	0	0	0	0	0	0
Slovakia	30,2	31,9	35,2	33,1	27,7	18,9	11,1	15,9	17,9	18,1	19,7	20,3
Finland	30,6	28,8	30,7	31,3	23,9	16	13,6	14,8	14,6	14,1	11,5	12
Sweden	54,8	50,1	47,6	49,2	44,2	40,7	36,8	39,8	38	39,6	39	36,3
United Kingdom	169,1	162,1	153,9	148,3	130,1	125	119,7	114	118	113	120	117
EU	2482,8	2328	2249,7	2262,6	1880	1827,1	1543,2	1619,4	1609,8	1688,6	1661,4	1582,6

Source: Eurostat, 2014

Table A2: Sugar beet production (1000 t) in the EU countries

geoTime	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Belgium	6537,1	6449,7	6215,9	5983,2	5666,6	5730,5	4713,5	5185,1	4464,8	5409	4830,4	4429,3
Bulgaria	51,3	9,1	26,4	24,7	26,8	16,3	0,1	0	0	0	0	0
Czech Republic	3832,5	3495,1	3579,3	3495,6	3138,3	2889,9	2884,6	3038,2	3065	3898,9	3868,8	3414,4
Denmark	3385	2857,3	2828,6	2762,6	2314,2	2255,3	2187,2	1898,2	2356,4	2700,4	2648,9	2300
Germany	26794,3	23715,7	27159	25284,7	20646,6	25139,1	23002,6	25919	23431,9	29577,5	27686,8	24643,4
Ireland	1300,7	1505,2	1861,4	1380	75,6	45	45	45	0	0	0	0
Greece	2531,5	2200	2095	2800	1650	855	1163,8	1600	761,5	324,4	434,9	335,8
Spain	8197,3	6365,1	7174,9	7275,7	5827	4910	4170,7	4225,4	3534,5	4188,5	3460,2	2804,9
France	33449,9	29329,5	30788,3	31149,6	29871,4	33212,7	30306,3	3491,3	31838,3	40406,9	33739	33200,3
Croatia	1183,4	677,6	1260,4	1337,8	1559,7	1582,6	1269,5	1217	1249,2	1168	919,2	1040
Italy	12726	7136,5	8473	14155,7	4769,6	4629,9	4390	3307,7	3550,1	3547,9	2501,2	2711,3
Latvia	622,3	532,4	505,6	519,9	473,9	11,1	0	0	0	0	0	0
Lithuania	1052,4	977,4	904,9	798,5	717,1	799,9	339,1	682	706,7	877,8	1003	902,7
Hungary	2273,8	1812,4	3251,9	3515,9	2454,2	1692,8	573,2	737	818,9	856,4	881,7	828
Netherlands	6250,2	6209,8	6292,2	5931	5414,1	5511,5	5218,5	5735	5280,4	5858	5735	5566
Austria	3043,4	2485,4	2901,9	3132,6	2493,1	2656,2	3091,4	3083,1	3131,7	3456,2	3114,4	3218
Poland	13433,9	11739,5	12730,4	11912,4	11474,8	12681,6	8715,1	10849,2	9972,6	11674,2	12349,5	10276
Portugal	643,9	484,1	626,6	604,9	320	251,6	137	6,6	4,2	8	18,9	0
Romania	954,6	764,5	672,7	729,7	1152,2	748,8	706,7	816,8	853	650,1	739,2	910
Slovenia	232,2	202,1	213,1	260,1	262	0	0	0	0	0	0	0
Slovakia	1346,2	1171,7	1598,8	1732,6	1370,9	846,5	678,9	898,8	977,7	1160,7	894,5	1011,1
Finland	1066	892,3	1063,5	1181,3	952	673,1	468	559	542,1	675,7	398,7	464
Sweden	2664,3	2484,4	2287,1	2381,2	2189	2137,7	1974,9	2405,8	1976,2	2493,2	2314,2	2090
United Kingdom	9556,8	9295,5	9042,1	8687	7400	6733	7641	8457	6527	8504	8400	8000
EU	143129	122792,3	133553	137036,7	112219,1	116010,1	103677,1	115578,9	105042,2	127435,8	115938,5	108145

Source: Eurostat, 2014

Table A3: Sugar beet selling prices (EUR) in the EU countries

geo/time	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Belgium	45,84	-	-	37,04	35,90	32,32	33,15	30,98	30,51	29,26	30,73	28,68
Bulgaria	25,14	23,56	21,00	21,25	22,04	21,50	22,26	28,33	28,33	28,33	28,33	28,33
Czech Republic	28,30	31,46	29,80	47,69	45,23	37,40	30,97	32,31	29,20	28,08	28,63	32,29
Denmark	44,42	41,45	50,06	47,85	46,16	-	-	37,96	42,17	36,39	36,64	36,68
Germany	-	-	-	-	-	-	-	-	-	-	-	-
Ireland	54,71	55,65	55,80	55,62	55,57	-	-	-	0,00	0,00	0,00	0,00
Greece	42,92	34,75	38,32	45,15	43,85	24,58	22,60	25,77	23,64	22,86	28,98	26,86
Spain	46,04	48,40	55,70	57,70	51,90	40,60	32,00	34,00	34,00	32,70	28,10	31,40
France	42,12	38,00	44,30	40,28	44,40	31,88	30,62	30,07	30,23	24,87	24,55	-
Croatia	-	-	-	-	-	-	-	-	35,00	33,00	40,00	45,00
Italy	-	-	-	-	-	-	-	-	-	-	-	-
Latvia	35,10	33,63	31,29	45,04	50,50	31,79	34,08	32,87	30,04	44,42	41,50	43,02
Lithuania	38,75	46,11	44,86	42,93	48,39	35,13	33,72	45,98	37,33	33,33	33,91	35,35
Hungary	30,32	34,57	35,54	41,86	41,26	36,29	30,42	27,72	-	-	-	-
Netherlands	55,20	44,85	48,40	49,35	45,45	45,00	36,90	-	40,00	43,00	45,00	60,00
Austria	46,71	41,43	50,62	45,58	40,13	37,26	31,17	29,23	26,33	28,78	37,77	40,57
Poland	30,29	29,05	28,22	41,31	43,57	33,05	28,61	29,51	26,73	28,31	34,95	32,78
Portugal	56,38	56,38	49,52	42,77	46,99	46,99	46,99	46,99	46,99	68,42	-	-
Romania	18,84	22,48	16,86	20,88	19,33	25,53	27,00	29,91	30,66	28,49	40,10	38,12
Slovenia	31,01	35,58	35,07	44,12	39,09	32,52	-	-	-	-	-	-
Slovakia	23,33	23,19	24,83	37,23	34,72	29,54	27,24	30,07	41,95	36,37	36,13	36,70
Finland	48,62	53,28	57,31	49,12	53,88	33,79	32,63	32,40	31,88	32,09	26,76	34,90
Sweden	-	-	-	-	45,73	32,73	29,86	28,08	25,90	25,69	26,69	25,73
United Kingdom	-	-	-	-	-	-	-	-	-	-	-	-

Source: Eurostat, 2014

Table A4: Sugar beet productivity (metric tons per hectare) in the EU countries

geoTime	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Belgium	69,6	72,8	73,8	76,0	80,1	80,9	75,7	82,7	71,6	87,0	78,9	74,1
Bulgaria	23,3	22,8	24,0	19,0	19,1	12,5						
Czech Republic	49,5	45,2	50,3	53,3	51,4	53,2	57,2	57,9	54,3	66,9	63,2	54,7
Denmark	58,6	57,6	58,1	58,8	55,9	57,2	60,1	50,0	60,1	67,5	64,9	60,5
Germany	58,3	53,2	61,7	60,2	57,7	62,4	62,3	67,6	64,4	74,3	68,9	68,9
Ireland	41,6	47,8	59,9	44,5	44,5	45,0	45,0	45,0				
Greece	61,0	56,4	63,5	65,9	61,3	62,9	82,0	66,1	57,7	59,0	53,7	57,9
Spain	72,0	63,8	69,6	71,3	68,2	72,0	79,7	84,8	81,4	93,3	88,7	89,9
France	76,4	73,4	80,1	82,3	78,8	84,4	86,8	93,7	83,1	92,8	86,6	84,1
Croatia	47,1	24,8	47,6	45,5	48,9	46,1	57,7	52,7	52,5	53,8	39,1	52,0
Italy	51,8	33,3	45,6	56,0	52,3	54,1	71,0	54,6	56,6	57,0	55,0	59,9
Latvia	39,1	37,0	36,6	38,5	37,3							
Lithuania	36,0	38,2	38,8	38,0	38,8	47,3	39,0	45,2	46,2	49,9	52,2	51,0
Hungary	41,0	35,1	52,5	57,1	52,4	41,1	59,7	53,4	58,9	56,3	47,1	46,8
Netherlands	57,4	60,4	64,4	65,0	66,0	67,1	72,3	78,9	74,8	79,9	78,6	76,0
Austria	68,1	57,5	64,9	70,9	63,3	62,8	71,9	70,2	69,9	74,2	63,2	63,3
Poland	44,3	41,0	42,8	41,6	43,8	51,3	46,5	54,3	48,3	57,4	58,3	52,9
Portugal	71,5	64,5	74,6	70,3	74,4	86,8	85,6	66,0	21,0	26,7	47,3	
Romania	22,9	16,9	32,3	29,0	28,9	26,1	34,6	38,3	39,1	34,4	27,0	32,3
Slovenia	51,6	37,4	45,3									
Slovakia	44,6	36,7	45,4	52,3	49,5	44,8	61,2	56,5	54,6	64,1	45,4	49,8
Finland	34,8	31,0	34,6	37,7	39,8	42,1	34,4	37,8	37,1	47,9	34,7	38,7
Sweden	48,6	49,6	48,0	48,4	49,5	52,5	53,7	60,4	52,0	63,0	59,3	57,6
United Kingdom	56,5	57,3	58,8	58,6	56,9	53,9	63,8	74,2	55,3	75,3	70,0	68,4
EU	57,6	52,7	59,4	60,6	59,7	63,5	67,2	71,4	65,3	75,5	69,8	68,3

Source: Author's calculation based on the Eurostat data

Table A5: Total revenue per hectare (EUR) in the EU countries

geotime	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Belgium			2.734,41	2.729,31	2.590,45	2.683,14	2.343,89	2.523,08	2.093,59	2.672,32	2.263,66
Bulgaria	549,38	477,75	510,00	418,76	411,57	279,11	0,00	0,00	0,00	0,00	0,00
Czech Republic	1.555,75	1.347,40	2.400,80	2.410,15	1.924,14	1.648,25	1.849,23	1.689,82	1.525,98	1.914,67	2.041,23
Denmark	2.427,48	2.883,80	2.779,23	2.713,23			2.280,94	2.106,50	2.187,48	2.473,57	2.381,41
Ireland	2.312,59	2.666,35	3.328,97	2.473,76				0,00	0,00	0,00	0,00
Greece	2.119,75	2.161,64	2.866,34	2.888,94	1.507,70	1.420,81	2.112,05	1.562,98	1.318,78	1.709,29	1.442,15
Spain	3.486,37	3.552,47	4.015,44	3.702,05	2.766,97	2.303,81	2.711,35	2.884,81	2.663,09	2.621,31	2.785,90
France	2.904,04	3.249,87	3.224,53	3.654,01	2.510,68	2.584,43	2.608,96	2.832,58	2.066,87	2.277,82	
Croatia								1.843,94	1.732,08	2.153,00	1.760,17
Latvia	1.316,22	1.156,86	1.650,16	1.944,81	1.186,24	0,00	0,00	0,00	0,00	0,00	0,00
Lithuania	1.661,85	1.712,74	1.667,27	1.839,97	1.361,71	1.596,01	1.792,16	1.686,03	1.539,50	1.691,26	1.846,67
Hungary	1.418,87	1.248,31	2.199,10	2.354,97	1.903,05	1.249,88	1.655,12				
Netherlands	2.574,12	2.923,68	3.178,30	2.952,51	2.971,15	2.477,15		3.155,43	3.216,11	3.596,32	4.713,70
Austria	2.820,76	2.912,29	2.959,03	2.844,15	2.357,69	1.957,30	2.101,43	1.849,16	2.011,84	2.801,30	2.562,90
Poland	1.287,97	1.157,14	1.768,90	1.813,50	1.447,49	1.466,53	1.371,64	1.450,72	1.367,85	2.004,98	1.909,51
Portugal	4.033,68	3.196,35	3.190,44	3.305,15	3.496,93	4.076,79	4.023,52	3.101,34	1.436,82		
Romania	515,85	285,17	675,29	559,73	739,09	704,45	1.036,15	1.175,73	1.114,77	1.379,31	1.028,41
Slovenia	1.835,93	1.312,53	2.000,42	0,00	0,00						
Slovakia	1.033,72	912,02	1.691,00	1.817,40	1.461,96	1.220,03	1.839,15	2.371,36	1.986,53	2.316,91	1.666,40
Finland	1.856,09	1.775,62	1.701,60	2.033,50	1.345,94	1.372,70	1.114,94	1.204,12	1.191,51	1.282,39	1.209,97
Sweden				2.213,26	1.620,95	1.568,35	1.506,93	1.565,58	1.336,02	1.680,39	1.526,78

Source: Author's calculation based on the Eurostat data

Table A6: Productivity in sugar beet production (comparison to the EU annual average) in the EU countries

geoTime	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Belgium	121%	138%	124%	126%	134%	127%	113%	116%	110%	115%	113%	108%
Bulgaria	40%	43%	40%	31%	32%	20%						
Czech Republic	86%	86%	85%	88%	86%	84%	85%	81%	83%	89%	91%	80%
Denmark	102%	109%	98%	97%	94%	90%	89%	70%	92%	89%	93%	89%
Germany	101%	101%	104%	99%	97%	98%	93%	95%	99%	98%	99%	101%
Ireland	72%	91%	101%	74%	75%	71%	67%	63%				
Greece	106%	107%	107%	109%	103%	99%	122%	93%	88%	78%	77%	85%
Spain	125%	121%	117%	118%	114%	113%	119%	119%	125%	124%	127%	132%
France	133%	139%	135%	136%	132%	133%	129%	131%	127%	123%	124%	123%
Croatia	82%	47%	80%	75%	82%	73%	86%	74%	80%	71%	56%	76%
Italy	90%	63%	77%	92%	88%	85%	106%	76%	87%	76%	79%	88%
Latvia	68%	70%	62%	64%	63%							
Lithuania	63%	72%	65%	63%	65%	75%	58%	63%	71%	66%	75%	75%
Hungary	71%	67%	88%	94%	88%	65%	89%	75%	90%	75%	68%	68%
Netherlands	100%	115%	108%	107%	111%	106%	108%	111%	115%	106%	113%	111%
Austria	118%	109%	109%	117%	106%	99%	107%	98%	107%	98%	91%	93%
Poland	77%	78%	72%	69%	73%	81%	69%	76%	74%	76%	83%	77%
Portugal	124%	122%	126%	116%	125%	137%	127%	92%	32%	35%	68%	
Romania	40%	32%	54%	48%	48%	41%	52%	54%	60%	46%	39%	47%
Slovenia	90%	71%	76%									
Slovakia	77%	70%	77%	86%	83%	71%	91%	79%	84%	85%	65%	73%
Finland	60%	59%	58%	62%	67%	66%	51%	53%	57%	63%	50%	57%
Sweden	84%	94%	81%	80%	83%	83%	80%	85%	80%	83%	85%	84%
United Kingdom	98%	109%	99%	97%	95%	85%	95%	104%	85%	100%	100%	100%
EU	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Source: Author's calculation based on the Eurostat data

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